EDGEWOOD CREEK
WATERSHED ASSESSMENT

WATERSHED PROJECTS
STRATEGY REPORT

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1.0 SUMMARY OF FINDINGS

The Edgewood Creek watershed lies predominantly within Douglas County, Nevada, with a small upper portion within California. The watershed drains an area of about 6.6 square miles at its mouth at Lake Tahoe (Figure 1). The land within the watershed has a variety of uses including the Stateline Casino area, Edgewood Golf Course, Heavenly Ski Resort, state and interstate highways, local roads, utility right-of-way corridors, residential neighborhoods, and public lands (state and federal).

The objective of the Edgewood Creek Watershed Assessment, funded by the State of Nevada, specifically the Nevada Tahoe Resource Team, is to evaluate the watershed with respect to stream morphology, fish and aquatic habitat, terrestrial wildlife and vegetation, and erosion hazards/sediment supply. The ultimate goal of the watershed assessment is to propose potential Environmental Improvement Projects (EIP's) that will reduce the cumulative impacts from historic resource harvesting, infrastructure installation and subdivision development. The primary objective of the Stream Corridor Assessment was to gain more insight into the health of the stream corridor and to evaluate the hydrologic and geomorphic function of the creek. The vegetation, fisheries and wildlife survey was used to support the Stream Corridor Assessment and to determine the overall health of the watershed. The objective of the Land Use/ Upland Watershed assessment was to determine the impacts on the water quality from the developed areas and the road network.

Channel and Bank Stability

Overall, stream channel banks in the watershed are relatively stable. The streams in the lower watershed have experienced aggradation and may experience loss of stability if additional aggradation continues. This aggradation is due to excessive erosion in the watershed from upland sources such as roadway drainage, erosion of disturbed surfaces, gully erosion from concentrated flows and increased flow rates from urbanized areas. Localized headcutting and areas of episodic downcutting have also been observed in the upper portions of the watershed. The additional sediment influx to the stream channel, has an impact on channel morphology as a result of aggradation or degradation below developed areas due to increased flow frequency. Some of the finer grained materials eroded from disturbed areas are of critical concern with respect to water quality in Lake Tahoe.

The most significant impacts to channel stability or function are in areas where channel re-alignments have occurred. Alteration of the natural channel geometry, slope and sinuosity modifies the function of the stream in these reaches and has compromised its capacity to naturally adjust to varying flow and sediment regimes.

Water Quality

The target pollutants of concern in the Lake Tahoe Basin are fine grained sediments and dissolved nutrients. The majority of these target pollutants originate from disturbed watershed areas and runoff associated with roadways and parking areas. The increased runoff volumes, associated with increases in impervious cover in the watershed, also exacerbate the problem by transporting these pollutants to Edgewood Creek and ultimately to Lake Tahoe. Water quality in

Edgewood Creek appears to be impacted by these factors and changes to morphology; alteration of riparian vegetation; in-stream ponds and sediment basins; the frequency and extent of maintenance activities; addition of dissolved iron of natural origin; and the discharge of potentially untreated stormwater from roadways. Use of the creek and the riparian zone for snow storage will also impact water quality since the snow contains significant volumes of de-icing abrasives.

Fisheries and Aquatic Habitat

The major findings of the fisheries and aquatic habitat assessment established that migratory fish in Edgewood Creek are blocked by a number of barriers, both natural and manmade. The lower mile has several manmade barriers to fish passage. Upstream of Friday Station Pond a natural boulder cascade blocks access to and from Lake Tahoe for migratory fish. The lower portion of the channel has been extensively modified which has reduced channel sinuosity and decreased riparian vegetation. This reach would benefit from channel improvements that could expand riparian vegetation and provide additional habitat for fish and wildlife. Some of the historically disturbed channels have stabilized over time.

Riparian/Upland Vegetation and Habitat

The majority of riparian vegetation, with the exception of heavily developed areas, is dense, thriving, and intact with reproduction occurring in numerous woody and herbaceous species. Some old growth conifers, including Jeffrey and sugar pines, as well as cottonwoods, occur in the watershed. Some conifer invasion of riparian zones is evident. Tahoe yellow cress, an endangered species, occurs at the outlet of Edgewood Creek. No other sensitive species were located, and habitat is limited.

Terrestrial Wildlife

The existing wildlife surveys and delineations within the watershed have determined that there is habitat for and/or occurrences of willow flycatcher, marten, mule deer, waterfowl, northern Goshawk, and pacific tree frog.

Land Use/Upland Watershed

Erosion control projects have been implemented in the urbanized areas of the upper watershed. These projects have provided source and treatment control measures that appear to address the majority of the potential sources of sediment production from cut slopes and other disturbed areas within public right-of-way in these subdivision areas. There are two locations identified where additional treatment control measures are needed to intercept roadway de-icing material as shown on Figure 3.8. Additional street sweeping and sediment vault cleaning is also needed to recover accumulations of roadway de-icing material. Regular street sweeping, sediment vault and sediment basin cleaning is needed to maintain the function of these facilities.

State Route 207 and US 50 will require the construction of source and treatment control measures to control the discharge of sediment from these roadways. Source control measures to

reduce cut slope, fill slope and shoulder erosion are needed. Segments of retaining wall will need to be reconstructed. Treatment control measures such as sediment vaults and sediment basins are needed to capture sediment mobilized by stormwater and snowmelt runoff. These roadways also use the greatest amount of roadway de-icing material which is not being captured. Significant quantities of these materials are evident in the roadway shoulders and adjoining stream zones. Additional shoulder treatments are needed to allow street sweeping equipment to operate in the roadway shoulders to pick up de-icing material before it is transported in the runoff.

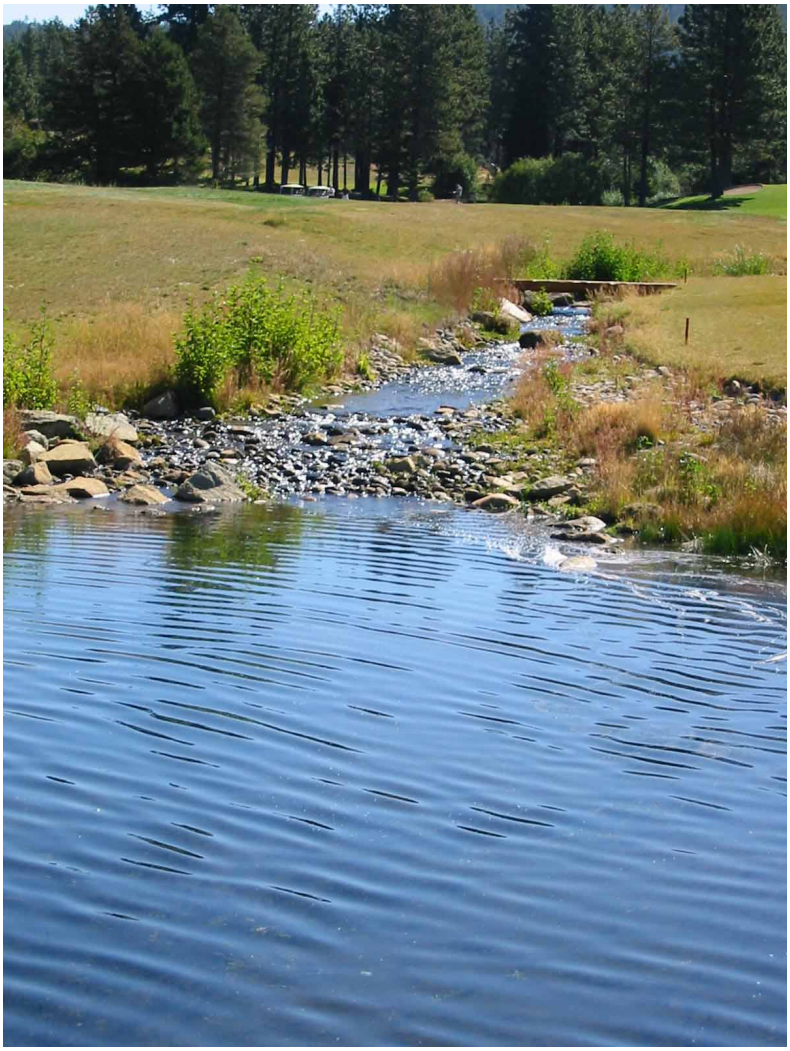
2.0 WATERSHED ASSESSMENT OBJECTIVES

The Edgewood Creek watershed assessment is directed towards determining the health of the watershed. From this determination the objective is to develop a list of mitigating measures (Environmental Improvement Projects) to aid water quality, aquatic habitat and to reduce the areas of soil erosion within the Nevada side of the watershed.

2.1 Strategies for Reducing Cumulative Impacts

The Edgewood Creek Integrated Watershed Assessment Team has identified numerous sources of watershed impacts that effect water quality in Edgewood Creek. Urbanization impacts are being addressed as funding allows each agency to respond. Several previous erosion control and water quality improvement projects have resulted in reduced erosion from disturbed areas through application of source control Best Management Practices (BMPs). Many treatment control BMPs have also been employed in the watershed that are capturing sediment and pollutants present in the runoff from some of the urbanized areas. Additional water quality benefits can be realized by enhancing the aquatic habitat and minimizing water quality impacts as described in Tech Memo II. Water quality benefits realized in Edgewood Creek will also benefit Lake Tahoe.

Aquatic habitat can be improved by enhancing sites that are impacting the Edgewood Creek SEZ. These impacts are mostly from the construction of drainage modifications for recreational sites adjacent to the creek (see photographs #1, 2). Stream zone improvements that improve the riparian zone adjacent to the creek will improve the health of the SEZs. The most effective and sustainable improvements will need to be determined from an alternatives analysis. For example, it may be desirable from an aquatic habitat and fish passage perspective, to remove the stormwater quality infrastructure that is within the SEZ. The removal or mitigation of the impact from this infrastructure may be costly and may not be supportable from a benefit/cost perspective.



Photograph #1: Reconstructed stream channel entering a pond on Edgewood Golf Course. Note proximity of fairways to SEZ and lack of developed or mature riparian habitat.

Photograph #2: Edgewood Creek has been highly modified through Reach 10. Cut and fill of the valley and annual removal of riparian vegetation has resulted in the formation of localized gullies. During spring snowmelt, it is likely that sediment is transported downstream

Water quality can be improved by protecting the aquatic habitat and by preventing roadway impacts to the creek. It is our opinion that the greatest impacts to water quality are as follows (not in order of significance):

- Untreated stormwater discharges to the creek from paved roadways
- Delivery of roadway de-icing abrasives to the creek
- Use of SEZs for snow storage
- Disturbances dirt roads or trails adjacent to the creek
- Disturbances to the creek riparian area
- Need for increased maintenance frequency of installed treatment control measures
- Need for increased frequency of street sweeping to capture roadway de-icing materials in the roadway shoulders
- Unimproved roadway shoulders that could facilitate street sweeping along SR 207.

One of the most significant factors to water quality is the discharge of untreated stormwater from paved roadways to the creek. SR 207 is the largest contributor since it receives the most intense application of de-icing material application and is the largest segment of roadway that has not been retrofitted with source and treatment control BMPs. This roadway runoff is conveying coarse and fine grained sediments, nutrients, and other pollutants to the creek (see photograph #3). The second significant contributor is the unpaved roadway that parallels the creek (see photograph #4). This road is in close proximity to the creek. Most of the subdivision roads and slopes have already been successfully treated and do not require additional significant mitigation measures. Road abrasive cast-off during snow removal operations from the two major highways (SR 207 and US 50 W) deposits this de-icing material to the edge or outside of the right-of-way. In some cases the major roadways are in close proximity to the creek allowing direct delivery of sediment laden runoff to the creek. This sediment will contain a fraction of fine or colloidal sediment that may be transported to Friday Station Pond and possibly to the lake (Tech Memo II). Friday Station Pond has captured significant quantities of larger grain sediments and some portion of the colloidal material originating upstream of the pond. The use of the SEZ as a snow storage area is also problematic because of the disturbance of the riparian area and presence of large volumes of de-icing material, salt, and other pollutants in melting snow.

Photograph #3: De-Icing abrasive and sediment accumulating in unimproved roadway shoulder of SR 207.

Photograph #4: Access road along Reach 2 of Edgewood Creek. The road impinges on the creek and captures drainage, resulting in gully formation and direct delivery of sediment to the stream channel. Property ownership is indefinite at this time.

Edgewood Creek is listed on the State of Nevada, Division of Environmental Protection 303 (d) list as water quality impaired for iron. Iron can be a micronutrient for some algal species and may be impacting water clarity in the lake. Without a detailed synoptic and fate study the source of this iron cannot be easily determined. Specific constituent water quality impacts of iron will require a detailed study. However, numerous areas of concern were identified including the main channel below Boulder Ski parking lot and the area along the north tributary behind the Post Office.

3.0 PROPOSED EIPS

The in-stream survey coupled with the upland vegetation, riparian vegetation, wildlife and land use survey was conducted from July 2002 to February 2003. The land use surveys also included road surveys and maintenance practice surveys. These surveys consisted of field reviews and interviews with maintenance staff at NDOT District 2. A review of previously identified EIPs recommended by earlier TRPA surveys was also conducted.

Tech Memo III provides a list of proposed projects intended to reduce sediment at its source of production and stream zone improvements to improve the natural function of the stream and improve habitat value. These EIP areas are shown on Figures 3.1 to 3.8.

The Watershed Assessment Team coordinated with Heavenly Valley Ski Area, Edgewood Golf course, NDOT and KGID to compile information to develop planning level estimates of the proposed EIPs. These preliminary cost estimates were generated based on similar projects in the

Tahoe Basin. In each instance, additional engineering analysis must be performed to determine the most cost effective alternative. These planning level estimates include preliminary costs for: design engineering, permitting, construction contingencies, mobilization/demobilization, construction management, administration, permitting and construction. It should also be noted that some of the EIPs identified are research of study costs rather than construction projects. In these instances additional data must be compiled to determine an appropriate course of action.

The Edgewood Creek Watershed Assessment Environmental Improvement Project List consists of 8 columns and is attached as Table 1. The narrative that follows describes the importance of each column. The first column "EIP" assigns a alphabetic code to the proposed EIP as a reference. Several figures are included in this section. These figures show the approximate location and extent of the proposed EIPs. The second column shows the location of the EIPs on Figure 2.2. If the proposed EIP is on a specific reach of the creek, then the third column shows the reach number. The fourth column "Location & Site Description" provides a brief description of the proposed EIP. Jurisdiction and ownership of the area where the proposed EIP is shown is identified in column five. The sixth column identifies the primary problem for which the EIP is intended to address. The seventh column describes the EIP. And the eighth column provides the preliminary estimate for the proposed EIP. As stated above, the cost data are preliminary estimates based on best available information. An improved estimate can only be developed after alternatives analysis has been prepared for a specific EIP.

3.1 Description of Proposed EIPs

Recommended EIPs are described in Table 1. Figures 3.0 to 3.8 provide locations of the impacts and the locations of the EIPs to mitigate these impacts.

EIP "A" (Figure 3.1) involves aquatic habitat improvement and fish passage enhancements on Edgewood Golf Course. Habitat improvement, specifically to the riparian zone, will also improve water quality. As detailed in Section 4.0 of Tech Memo II, the lower portion of the creek is the only spawning habitat available to migratory fish species. Improving the accessibility of the lower creek to migratory fish will improve the function of this stream segment. Increasing riparian vegetation to provide a plant canopy for shade and cover along with providing streambed substrate of appropriate size will enhance the aquatic habitat by providing spawning and resting sites for migratory fish species.

EIP "B" (Figure 3.1) is a sediment control project on the Park Cattle Company land. Repairs to the FSP gate are necessary to regulate flows. The emergency spillway appears to be undersized and may erode during high flow, especially if discharge from the bottom of the pond is restricted. The tributary entering the pond from the north has unstable banks with lateral migration possibly caused by channel incision (EIP "J").

EIP "C" (Figure 3.1) includes improvements to reduce erosion and increase riparian resources. The tributary entering Edgewood Creek from the south at the west end of this EIP is actively eroding and requires channel bank stabilization and grade control. A pond has been constructed adjacent to the creek with the placement of a levee that encroaches into the stream zone. This levee is not stable and will likely be breached by high flows. The levee should be removed or

stabilized using a bio-engineering approach which will also add riparian vegetation to the creek bank. The jurisdiction and ownership of EIP "C" is somewhat difficult to determine because of inaccuracies in the parcel database. Surveying will be necessary to determine ownership in the areas where improvements are proposed. This area has federal (USFS), State (NDSL) and private ownership.

EIP "D" (Figure 3.2) is intended to reduce sediment generation and increase riparian habitat to improve stream function and water quality. There is a dirt road adjacent to the creek in this area that is used by Douglas County for maintenance of utilities. This roadway also experiences significant recreational use by motor vehicles and mountain bikes. The heavy usage has resulted in disturbance of areas adjacent to the road as well. Although the road is on USFS property, the USFS may not be the party that is responsible for its maintenance. In some cases the road encroaches upon the SEZ and may be supplying sediment directly to the creek. Strategic placement of treatment control BMPs is needed. Due to heavy usage, revegetation may not be effective due to frequent disturbance by vehicular, bike and pedestrian traffic. In order to accomplish the needed source control measures, it may be necessary to restrict recreational traffic on the road. The mainstem of the creek in this reach has some minor areas with channel bank instabilities. Stabilization of the bank with a bio-engineering approach will increase habitat complexity and will also increase riparian resources. This area has multiple owners and jurisdiction. The USFS, Douglas County and Heavenly Valley Ski Area may all be using this roadway.

EIP "E" (Figure 3.1) consists of stream segment grade control and channel bank stabilization measures at several locations. A tributary of the North Fork of Edgewood Creek is vertically unstable. Gabion grade control structures have been installed but have been ineffective. The channel has eroded around the ends of some of the structures which has accelerated erosion. The gabions should be removed and replaced with a series of smaller grade control structures properly shaped and keyed into the channel banks to prevent erosion at the ends of the structures. Due to the steep gradient, other types of mechanical treatment may also be necessary. A road on the North Fork appears to have historically acted as a levee for a pond. The stream channel has been rerouted to the edge of this levee causing erosion of the embankment. The levee should be stabilized to prevent erosion. Improvements in this area should also be made to create a larger wetland treatment area for the purpose of improving water quality. Property ownership is difficult to determine due to inaccuracies in the parcel database. Appropriate surveys should be conducted to determine ownership boundaries on proposed project sites. The EIP area appears to be located on private property and USFS lands.

EIP "F" (Figure 3.3) is intended to provide source control and increased riparian resources. Stormwater runoff from the Boulder Ski parking lot and the storage of snow removed from the parking lot in the active SEZ is impacting water quality and the riparian zone adjacent to the creek. Treatment control BMPs should be provided in the Boulder Parking Lot at the Ski Area. A snow storage area needs to be developed outside of the SEZ with treatment control BMP's to treat the snowmelt runoff. Development and maintenance of the lower and middle segment of the Edgewood Bowl Ski Run continues to minimize the riparian vegetation in the SEZ. The implementation of an erosion control and vegetation enhancement plan is needed to stabilize the SEZ. Minor gullies should be repaired and the water distribution pipes should be removed from

the SEZ to allow maintenance of these facilities without disturbing the SEZ. The USFS and Heavenly Ski Area are the primary property owners.

EIPs "G", "H" and "I" are necessary to reduce SR 207 impacts upon the creek. The location of existing features in these EIP areas are shown in Figures 3.4 – 3.6. Untreated stormwater discharge from the roadway surface and close proximity of the road to the creek is causing water quality impacts and delivery of sediment from cut slopes and de-icing operations to the creek. The increased sediment supply to the creek has resulted in areas of aggradation. Source control measures to decrease erosion of cut and fill slopes are needed. Treatment control measures such as improved shoulders, retaining walls, sediment vaults, sediment basins and oil-water separators are also necessary. Improvements that provide for snow removal and storage consistent with maintenance practices required for public safety need to be investigated to reduce direct cast off and snow storage in the SEZs. Review of the maintenance practices for this segment of SR 207 could result in decreased application of roadway de-icing abrasives. NDOT is the primary property owner impacted by this EIP. However, private property acquisition may be necessary to construct and implement an effective source and treatment control program for SR 207. The nature of the needed source and treatment control elements are described in Technical Memorandum 2.

EIP "J" (Figure 3.7) is the lower Kingsbury subdivision. Runoff from this highly impervious area is directed into the Friday Station Pond (EIP "B"). The channel conveying this drainage enters the pond on the north side. The channel is laterally and vertically unstable. Erosion of the channel is increasing sediment yield to the pond. This area will require stream channel stabilization, inclusion of treatment control BMPs for oil/grease removal and capture of de-icing material from snow storage and street runoff. Property owners include multiple private property owners, Park Cattle Company and NDOT.

EIP "K" (Figure 3.8) is the Upper Kingsbury sub-division. The slopes and roads within this subdivision have been improved recently with source and treatment control BMPs. Some additional needs have been identified that were not addressed by previous projects. A sediment basin is needed to capture sediment from roadway drainage adjacent to North Benjamin Drive before this drainage enters the SEZ. Significant sediment accumulation has taken place in the SEZ. Adjacent to South Benjamin Drive, additional sediment storage appears to be needed at this location. This area also appears to need more frequent street sweeping and sediment removal from the existing sediment vaults to increase the effectiveness of the treatment control measures installed. Some private property acquisition is likely to be needed to implement this EIP.

EIP "L" consists of a study to evaluate level of conifer invasion existing riparian associated plant communities such as willow, alder, and aspen. Conifer invasion of aspen stands may result in the loss of a genetic clone specifically adapted to a certain site. This invasion is not localized and may be present in areas other than those noted. For this reason a study is necessary to identify all impacted sites and to develop a plan to aid aspen recruitment and retard conifer invasion. Once the areas have been identified, conifer removal prescriptions can be used to aid riparian plant community recruitment. The responsible agency or party has not been determined.

EIP "M" consists of a study to evaluate the water quality impacts of Friday Station Pond. The pond may be a benefit or a detriment to the creek water quality. It is also possible that the pond may be used to reduce and remove fine sediment generated within the watershed. The responsible agency or party has not been determined.

EIP "N" is to control the spread of invasive and noxious plants. Andria Drive, Brautovich Park, Kingsbury Grade and Edgewood Golf Course were identified as locations with unwanted plant species. These invasive and noxious plants should be controlled or eradicated and subsequently revegetated. The responsible agency or party has not been determined.

EIP "O" is a study to determine the source of biologically available iron in Edgewood Creek. Iron can stimulate select algal growth and may be impacting lake water clarity. The source of this iron appears to be from geothermal flows and is a natural occurrence. Another possible source could be imported construction fill. If an iron TMDL is to be developed, the sources of iron need to be identified. The responsible agency or party has not been determined

4.0 CONCLUSIONS

The greatest impact to the Edgewood Creek Watershed is from potential sediment generation from untreated slopes; roadside channels that need source and treatment control BMPs; stream channels that need to be stabilized; and roads (dirt and paved) that convey the sediment in roadway runoff to the creek. Roadway de-icing sand is a significant portion of the sediment being transported from the paved roadway surfaces.

Recreational development within the watershed impacts the aquatic habitat of the creek, which subsequently impacts water quality. Outside of the SEZ the primary impact of recreational uses would be erosion from disturbed areas of the watershed.

Mitigation of impacts to the creek and its SEZ will result in significant benefit to the watershed. The water quality and aquatic habitat of the watershed can be significantly improved by implementing the EIPs recommended in Table 1.

Potential stages for further evaluation and implementation of proposed IEP's would be (not in order of significance):

- Formation of a Technical Advisory Committee (TAC) or focus group.
- Master plan development for SR 207 (NDOT).
- Working within internal guidelines of individual entities.
- Incorporation of EIPs into TRPA planning documents.

TABLE 1 - Edgewood Creek Watershed Assessment Environmental Improvement Projects List**

EIP	Site # from Figure 2.2	Reach #	Location / Site Description	Jurisdiction & Ownership	Impact Identified	Proposed EIP and Watershed Restoration Opportunities	* Estimated Project Cost
A	1A	R9	18th green culvert to Lake Tahoe	Edgewood Golf Course	Fish passage	Modify pond outlet to provide fish passage: To overcome fluctuating lake levels we recommend daylighting the culvert and installing rock vortex weirs to facilitate fish passage and to step the creek up to the pond elevation.	$453,000
	1B	R9	Within Edgewood Golf Course between Lake Tahoe and Hwy 50.		Fish passage	Improve fish migration from the lake and from the lower portion of the creek. Modify the diversion structure at the bridge between Fairway 5 and 12. Either construct a fish ladder or replace diversion structure with a naturalized step-pool channel	$234,000
	17	R9	Within Edgewood Golf Course between Lake Tahoe and Hwy50.		Riparian resources; habitat complexity; channel morphology; water quality	Increase riparian vegetation along the creek. Provide shade canopy if feasible. Improve streambed substrate and weir configuration to improve fish passage at existing drop structures.	$346,000
B	3	R8	Upstream of Hwy 50 on the mainstem of Edgewood Creek. Friday Station Pond.	Park Cattle Company	Sediment source	Repair or replace outlet structure: The existing outlet structure should be modified to reduce potential clogging issues. The emergency spillway currently being used is not adequate to handle consistent peak flows and must either be modified or replaced.	$450,000
	4	R8	Upstream of Hwy 50 on the mainstem of Edgewood Creek. Two large gullies on the south side of Friday Station Pond.		Sediment source	Repair gullies and modify drainage: The gullies should be repaired and stabilized with vegetation. Additionally, concentrated flow regime should be modified to prevent and arrest future gullying.	$33,000
C	19	trib	On the second tributary to Edgewood Creek. Gullies and headcuts.	USFS/NDSL/ Private/Other Property ownership difficult to determine.	Sediment source	Stabilize stream channel: Although most of the potential incision has already occurred, several streambanks are still actively eroding. A range of treatment options exists for this site, from site-specific vegetative stabilization, to reconstruction of the stream channel.	$360,000
	9	R5	Between the second tributary and the confluence of North Fork and mainstem of Edgewood Creek. On the mainstem off-channel pond with levee.		Sediment source; riparian resources	Stabilize levee toe: Although the erosion of the levee is not severe, there is the possibility of a more significant levee failure in the future. The toe of the levee should be stabilized with a biotechnical and a bio-engineering approach. May need surveying	$39,000

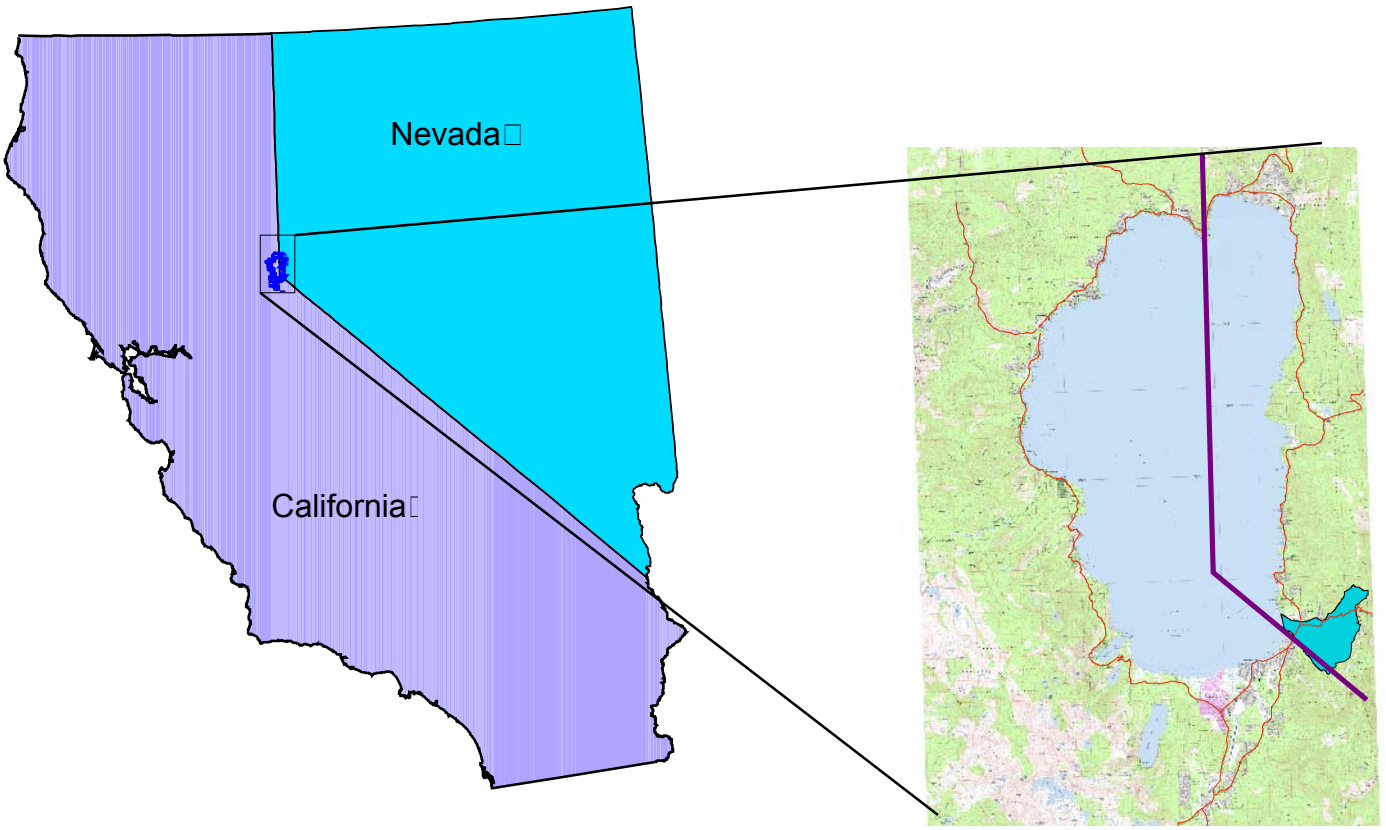
EIP	Site # from Figure 2.2	Reach #	Location / Site Description	Jurisdiction & Ownership	Impact Identified	Proposed EIP and Watershed Restoration Opportunities	* Estimated Project Cost
D	21	R1, R2	Mainstem of Edgewood Creek. Road parallel to Edgewood Creek.	USFS/Douglas County/ Heavenly Valley	Sediment source	Upgrade road and add BMP's: Best management practices should be implemented to improve the condition of the road and reduce erosion. Manage off-road activities.	$227,000
	114 thru 120	R1, R2	Mainstem of Edgewood Creek.		Riparian resources; habitat complexity; channel morphology; water quality	Stabilize eroding streambank: Using bio-engineering and restoration practices stabilize eroding streambank and increase riparian vegetation.	$40,000
E	14	R3	Tributary to North Fork of Edgewood Creek. Gullies and headcuts.	Private Prop./USFS	Sediment source	Repair gullies: The gullies should be repaired and stabilized to reduce future erosion through the use of hard armoring combined with woody debris. Remove existing rock gabions and limit velocity increase	$81,000
	13,26	R3	North Fork of Edgewood Creek.		Sediment source	Stabilize channel, reduce roadway impacts and potentially provide treatment: Road fill in this area appears to have historically functioned as a small earthen dam. The stream channel was routed to the edge of the resulting pond. Project options here range from stabilization of the existing channel to routing the channel through the former pond, a wetland area that could provide water quality treatment. Exact property location is difficult to determine. May need surveying.	$108,000
F	12	R1	Boulder Parking Lot on the mainstem of Edgewood Creek in the vicinity of Heavenly Ski Area.	Heavenly Valley/USFS	Sediment source	Heavenly Boulder Parking Lot BMP installation: Install a comprehensive surface water treatment system to treat a 20 year, 1 hour storm event. Include sites for snow-storage and containment of snowmelt outside the active SEZ.	$750,000
	22	R10	On the mainstem of Edgewood Creek. In the vicinity of Heavenly Ski Area.		Sediment source; riparian resources	Revegetate and/or stabilize barren areas that contribute sediment to Edgewood Creek within the lower and middle segments of Edgewood Bowl Ski Run and within Heavenly Ski Resort. Develop an erosion control and vegetation management plan that will protect the future integrity of the channel while still providing recreational use of the site. Repair gully and stabilize with vegetation. Move well pipes out of SEZ.	$55,000
G	NDOT Lower Kingsbury Grade		Lower Kingsbury Grade, Route 207.	NDOT	Sediment source	Stabilize roadside slopes: Oil and sediment traps, and potentially sediment basins should be installed in these areas to reduce direct input of untreated storm water into the channel. Revise road abrasive application and capture of cast-off.	$2,823,654
H	24 and NDOT Middle Kingsbury	R4	Middle Kingsbury Grade Route 207.	NDOT	Sediment source. Stormwater treatment. Roadway Discharge.	Stabilize road shoulders, roadside channels and roadside slopes; Treat road run-off before it enters the creek Oil and sediment traps, and potentially sediment basins should be installed in these areas to reduce direct input of untreated storm water into the channel. Revise road abrasive application and capture of cast-off.	$3,141,656
I	NDOT Upper Kingsbury		Upper Kingsbury Grade Route 207.	NDOT	Sediment source	Stabilize road shoulders, roadside channels and roadside slopes: Oil and sediment traps, and potentially sediment basins should be installed in these areas to reduce direct input of untreated storm water into the channel. Revise road abrasive application and capture of cast-off.	$3,122,564

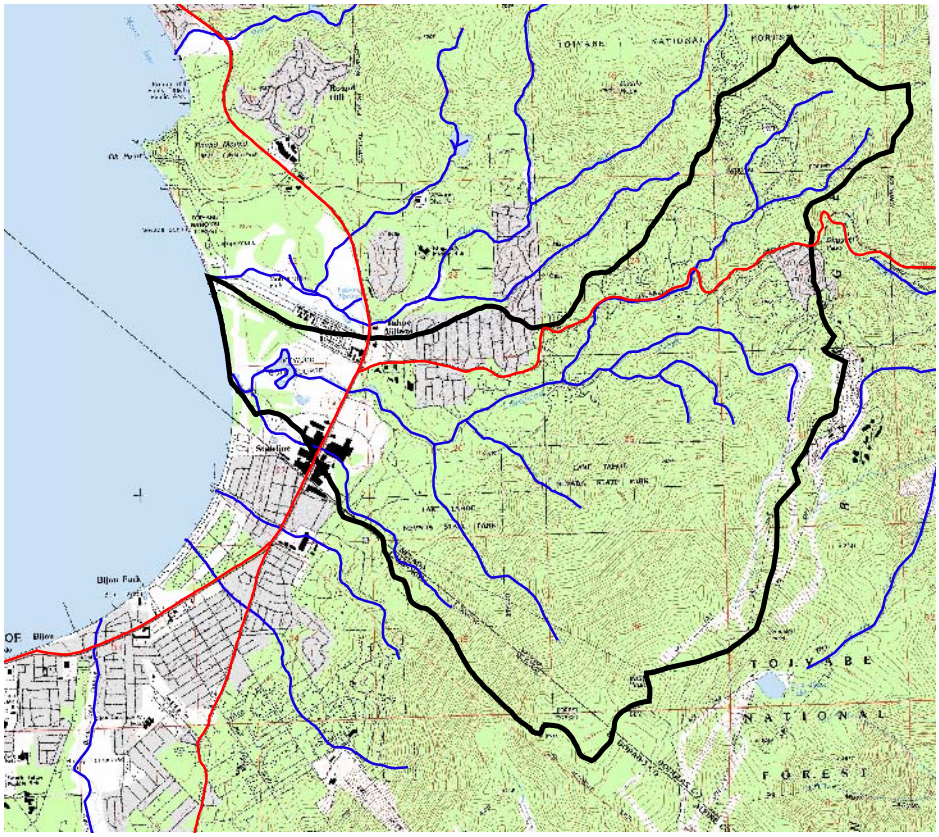
EIP	Site # from Figure 2.2	Reach #	Location / Site Description	Jurisdiction & Ownership	Impact Identified	Proposed EIP and Watershed Restoration Opportunities	* Estimated Project Cost
J	KGID Lower Kingsbury		Lower Kingsbury Subdivisions.	KGID/ Douglas County/ Private Property	Sediment source. Water quality impacts from potentially untreated stormwater.	Provide stormwater treatment for lower Kingsbury business district and arrest headcutting: Oil and sediment traps, and potentially sediment basins or sediment basin retrofits should be installed in this area to reduce direct input of untreated stormwater from parking lots into the creek. Develop snow storage areas away from the creek. Revise road abrasive application and capture of cast-off.	$36,017
K	KGID Upper Kingsbury and North Benjamin		Upper Kingsbury & North Benjamin road shoulders, road-side ditches and untreated slopes	KGID/ Douglas County	Sediment source. Water quality impacts from potentially untreated stormwater.	Stabilize road shoulders, roadside channels and roadside slopes: Oil and sediment traps, and potentially a sediment basins should be installed in this area to reduce direct input of untreated storm water into the channel. Revise road abrasive application and capture of cast-off. BMP unpaved roads.	$288,584
L			Adjacent to all of Edgewood Creek	?	Potential recruitment of Aspen and other riparian shade producing species	Aspen Recruitment: Conduct a detailed field feasibility assessment in the region(s) of the watershed on the reduction of conifer invasion and recruitment of Aspen and other shade producing species in the riparian zone. If feasible use conifer removal; low to moderate intensity burning; mechanical pushing and other processes that may be available.	$66,600
M		R9	Friday Station Pond. Study on downstream water quality impacts	?	Possible benefit and detriment due to sediment removal	Study impact of pond on lower Edgewood Creek: Implement study to determine benefit or detriment to water quality and aquatic habitat due to Friday Station Pond.	$50,000
N			Andria Drive, Brautovich Park, Kingsbury Grade, and Edgewood Golf Course.	?	Invasive and noxious plants	Control noxious plants: Reduce invasion by unwanted plant species.	$18,000
O			From Boulder Lodge Parking Lot downstream. Mostly on the mainstem	?	Iron and other mineral deposits	Conduct study to determine the source of iron and other minerals being deposited in the creek. Deposits of biologically oxidized iron are present in the creek. Determining sources may be necessary prior to establishing a loading criteria.	$37,000
						GRAND TOTAL	**$12,760,076**

* These budgetary costs include 20% contingency, construction mobilization/demobilization, construction management, permitting, engineering design, and administrative

? Jurisdiction and ownership is unknown

****THESE COSTS ARE APPROXIMATE PLANNING LEVEL ESTIMATES AND SHOULD NOT BE USED AS ACTUAL CONSTRUCTION COSTS.**



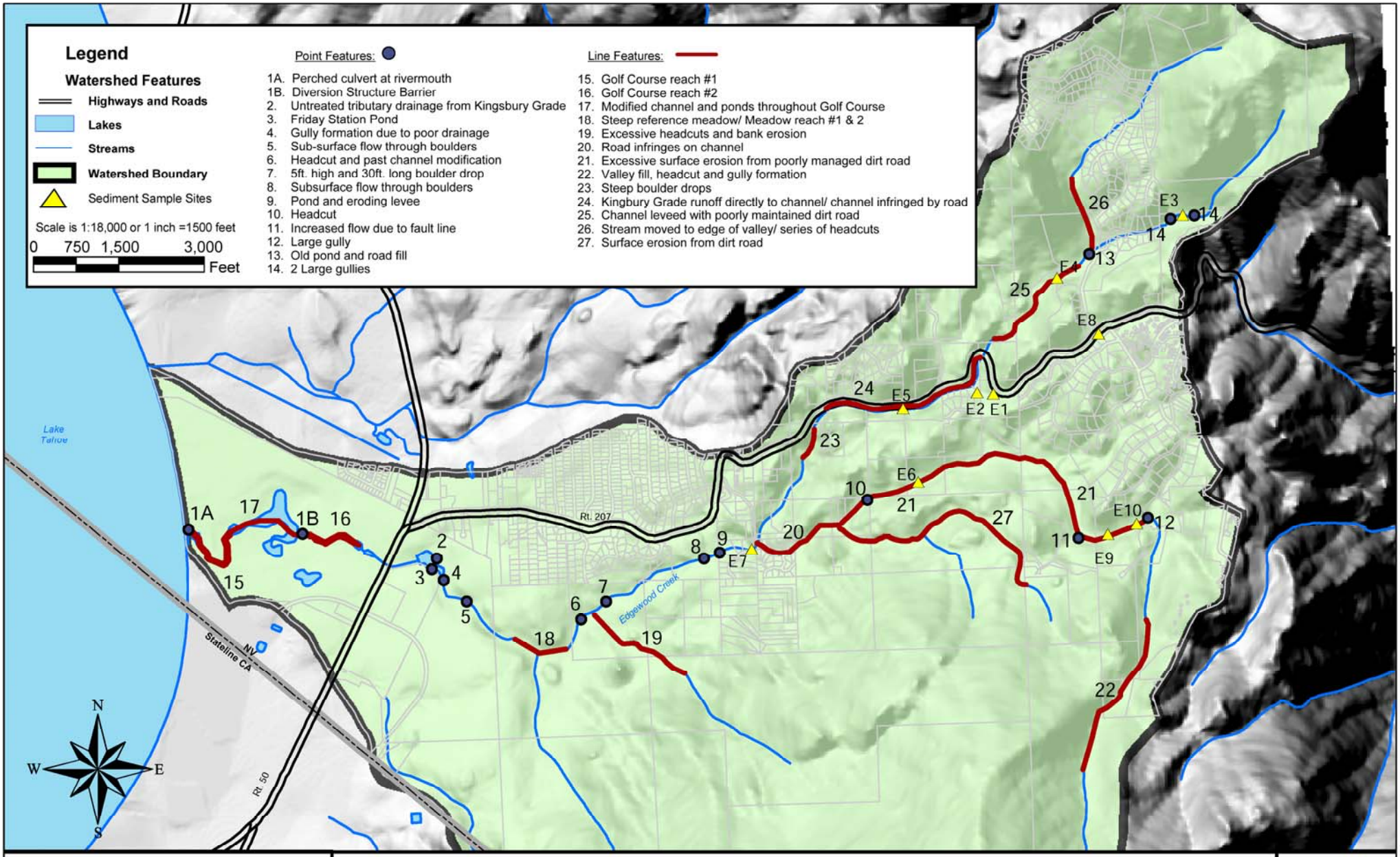


Legend

- Major Roadway
- Edgewood Watershed
- Streams

NTS

Edgewood Creek Integrated Watershed Assessment Team	Edgewood Creek Site Map	Figure 1



Edgewood Creek
Integrated Watershed
Assessment Team

Edgewood Creek Watershed
Stream Corridor Walk-Through Survey - Identified Watershed Features

Figure 2.2

Legend

- Stream Reach Breaks
- Gully formation
- Large gully
- Old pond and road fill
- Perched culvert at river mouth
- Pond and eroding levee
- Untreated tributary flow and headcut
- Headcuts and bank erosion
- Surface erosion from dirt roads
- Runoff directly to channel/ channel infringed by road
- Modified channel and ponds
- Dirt road infringes on channel
- Stream moved to edge of valley/ series of headcuts
- Valley fill, headcut, and gully formation
- Roads/Erosion Control Survey Area
- Edgewood Creek Watershed Area

Lake Tahoe

Nevada

California

Maryanne Dr.

N. Benjamin Dr.

S Benjamin Dr.

SR 207

SR 207

Meadow Dr.

Highway 50 West

R1

R2

R3

R4

R5

R6

R7

R8

R9

Friday Station Pond

0 0.25 0.5 1 Miles

Edgewood Creek Watershed

Stream Corridor and Watershed Walk Survey

Edgewood Creek Integrated Watershed Assessment Team

C:\GIS\3090-edgewood\edgewood map

Modified: 6/10/03

Figure 3.0

N W E S

Legend

- Stream EIP Areas
- Road EIP Areas
- Edgewood Creek Watershed
- Stream Reach Breaks

EIP Areas

A, Edgewood Golf Course

B, Park Cattle Company

C, USFS, NDSL, Private or Other

D, USFS, Douglas County, Heavenly Valley

E, Private Property, USFS

F, Heavenly Valley, USFS

G, NDOT Lower Kingsbury

H, NDOT Middle Kingsbury

I, NDOT Upper Kingsbury

J, Lower Kingsbury

K, North Benjamin and Upper Kingsbury

Land Ownership

- DOUGLAS COUNTY
- HEAVENLY VALLEY
- KINGSBURY GENERAL IMP. DISTRICT
- NEVADA, STATE OF
- PARK CATTLE COMPANY
- U S FOREST SERVICE
- PRIVATE PROPERTY OR OTHER

SOURCE OF INFORMATION: USFS PARCEL BASE

Lake Tahoe

SR 207

Highway 50 West

KGID Parcel

R1 R2 R3 R4 R5 R6 R7 R8 R9 R10

A B C D E F G H I J K

0 0.25 0.5 1 Miles

Edgewood Creek Integrated Watershed Assessment Team

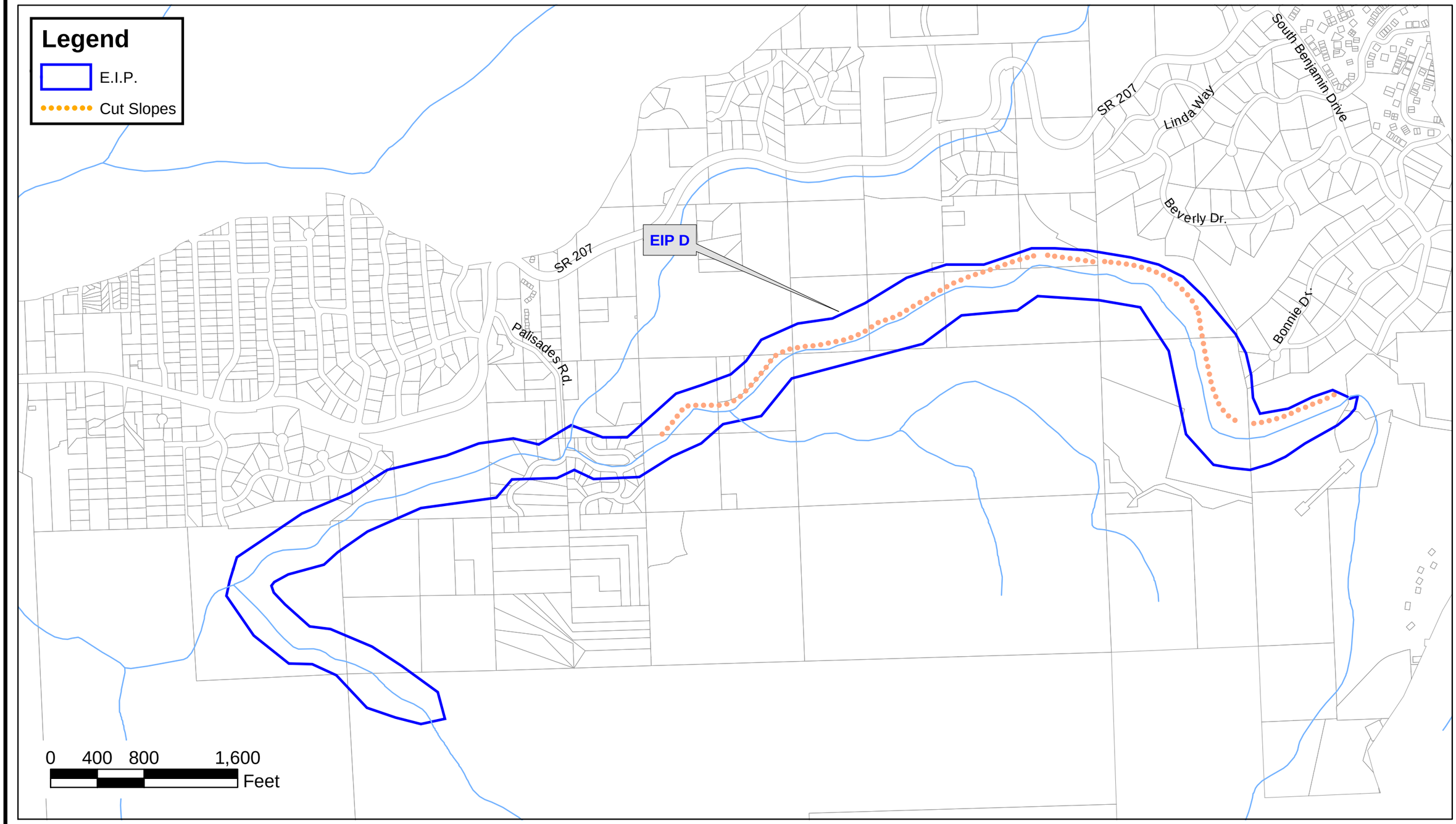
Proposed Edgewood Creek Watershed EIPs

Figure 3.1

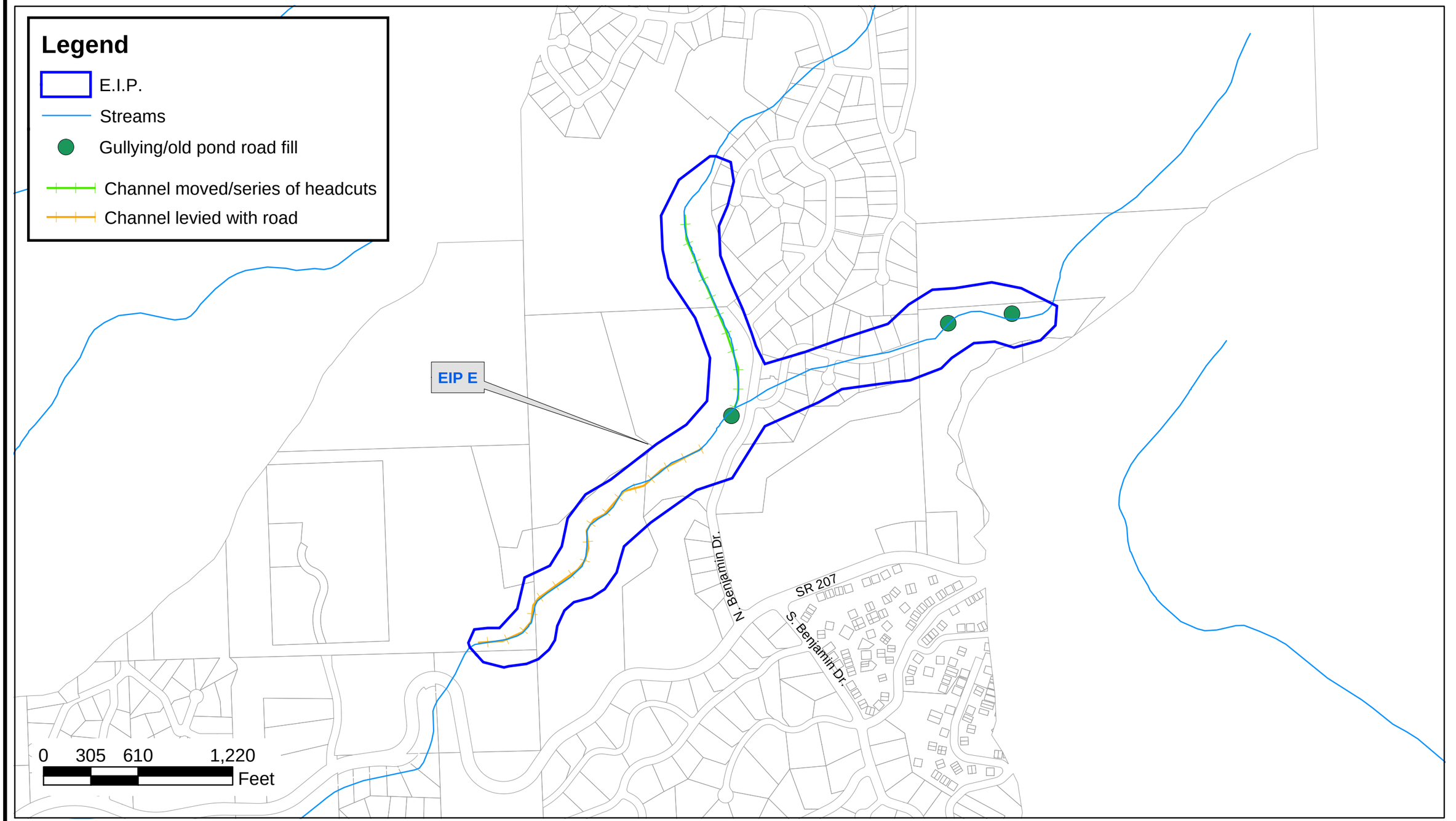
N W E S

C:\GIS\3090-edgewood\edgewood EIP areas

Modified : 6/10/03



Edgewood Creek Integrated Watershed Assessment Team	**Main Stem Bank Treatment Opportunities** **Proposed Edgewood Creek Watershed EIP** C:\GIS\3090-edgewood\main stem defic Modified : 6/10/03	**Figure 3.2**



Edgewood Creek Integrated Watershed Assessment Team

North Fork Opportunities

Proposed Edgewood Creek Watershed EIP

C:\GIS\3090-edgewood\kgid low king defic

Modified : 6/10/03

Figure 3.3

N W E S

Legend

- E.I.P.
- Road Shoulders
- Cut Slopes
- Earth Channels

Pineridge Dr

Meadow Ln.

Hall Ct.

Terrace View Dr.

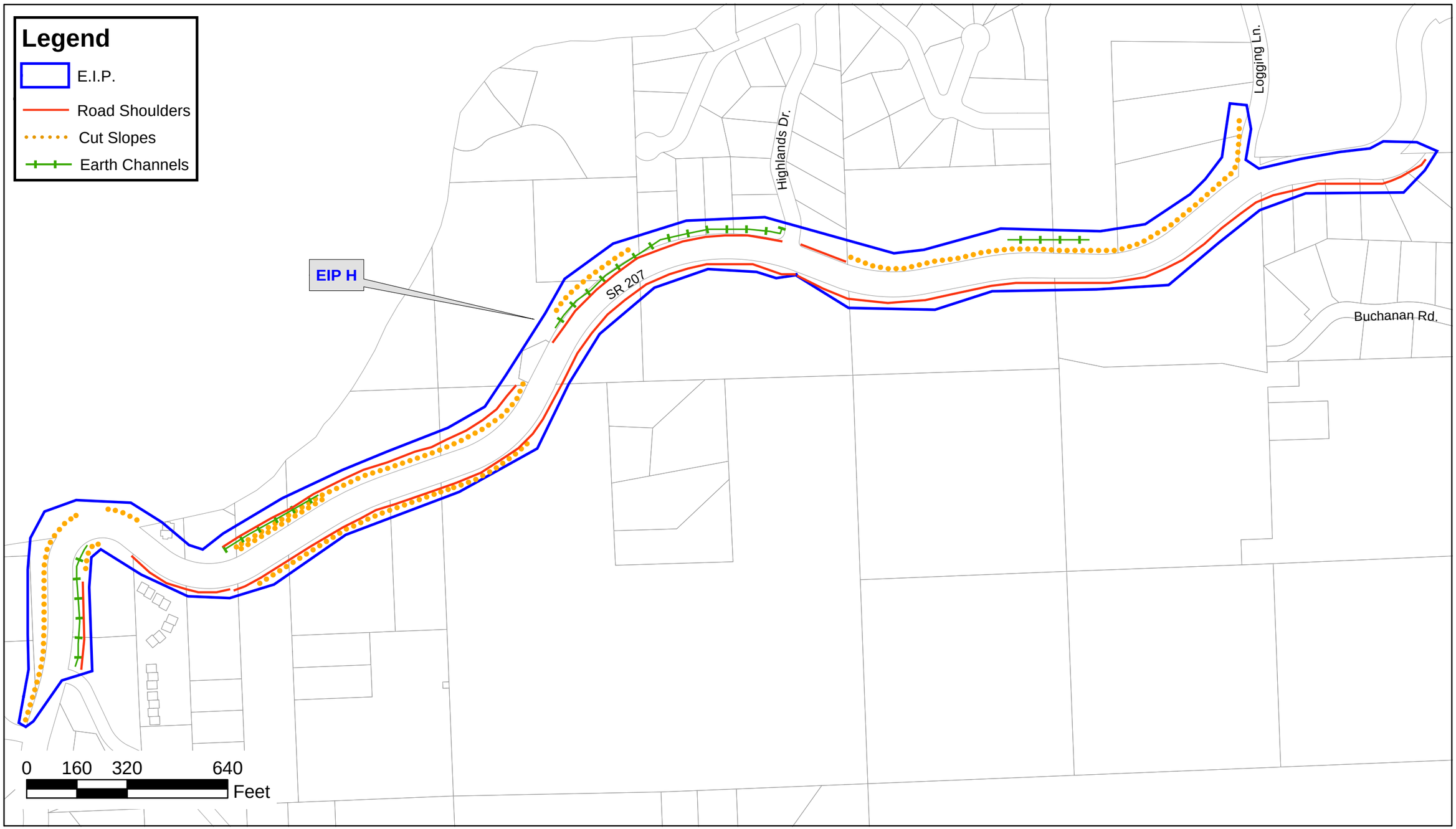
EIP G

Route 207

0 155 310 620

Feet

Edgewood Creek Integrated Watershed Assessment Team	**Lower Kingsbury (SR 207) Opportunities** **Proposed Edgewood Creek Watershed EIP** C:\GIS\3090-edgewood\ndot low king defic Modified : 4/24/03	**Figure 3.4**	N W E S



Edgewood Creek Integrated Watershed Assessment Team

Middle Kingsbury (SR 207) Opportunities

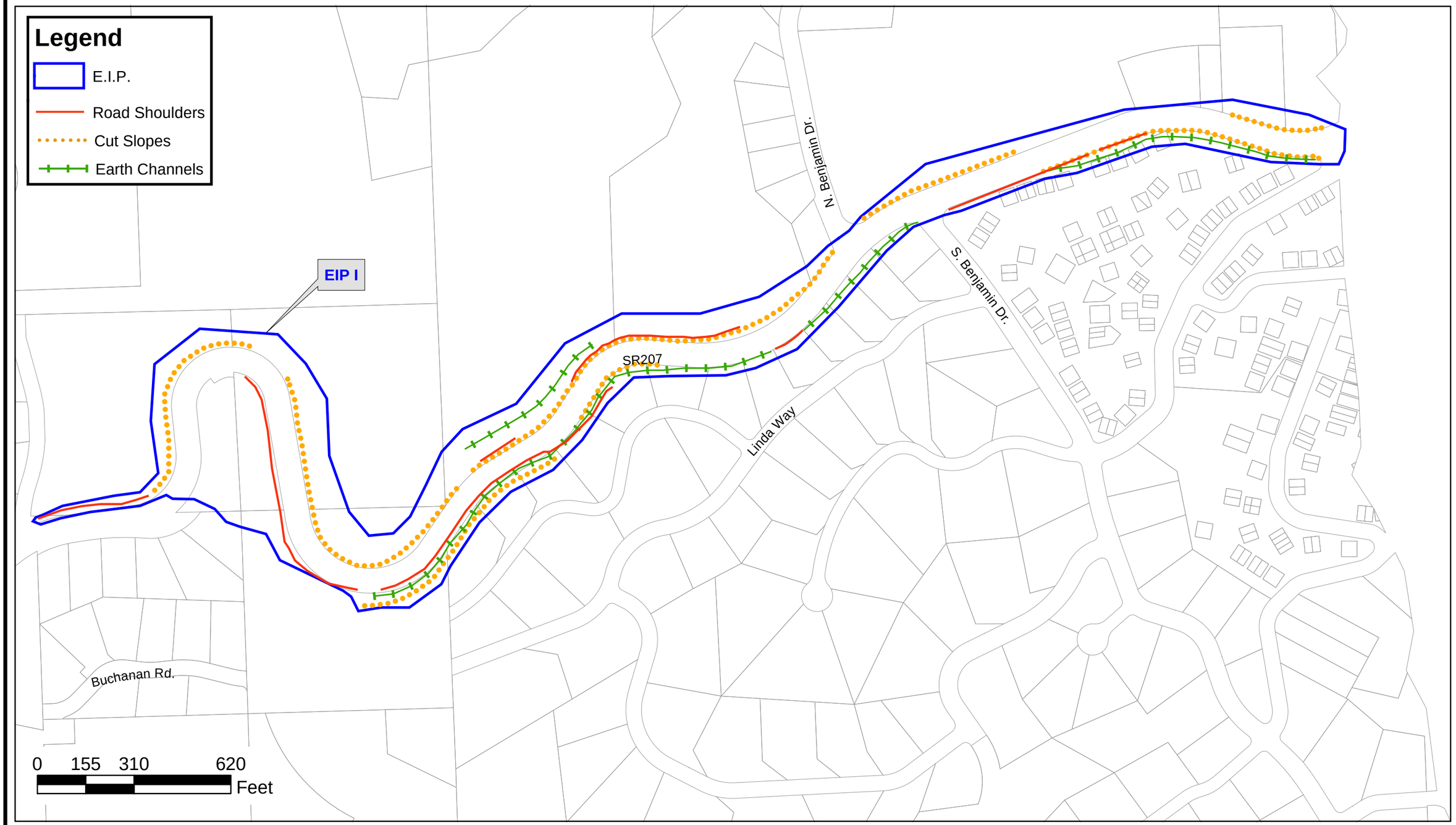
Proposed Edgewood Creek Watershed EIP

C:\GIS\3090-edgewood\ndot mid king defic

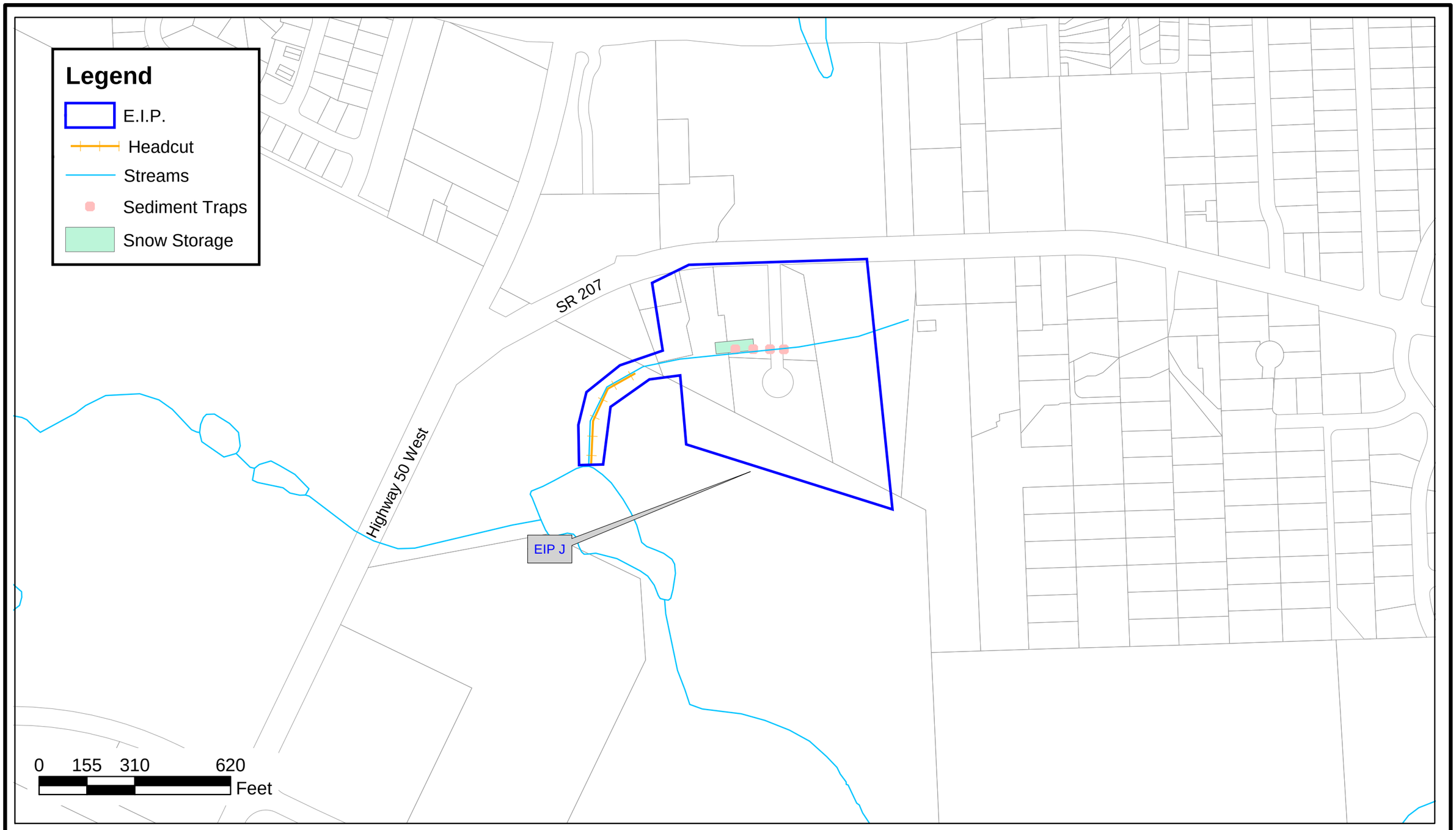
Modified : 6/10/03

Figure 3.5

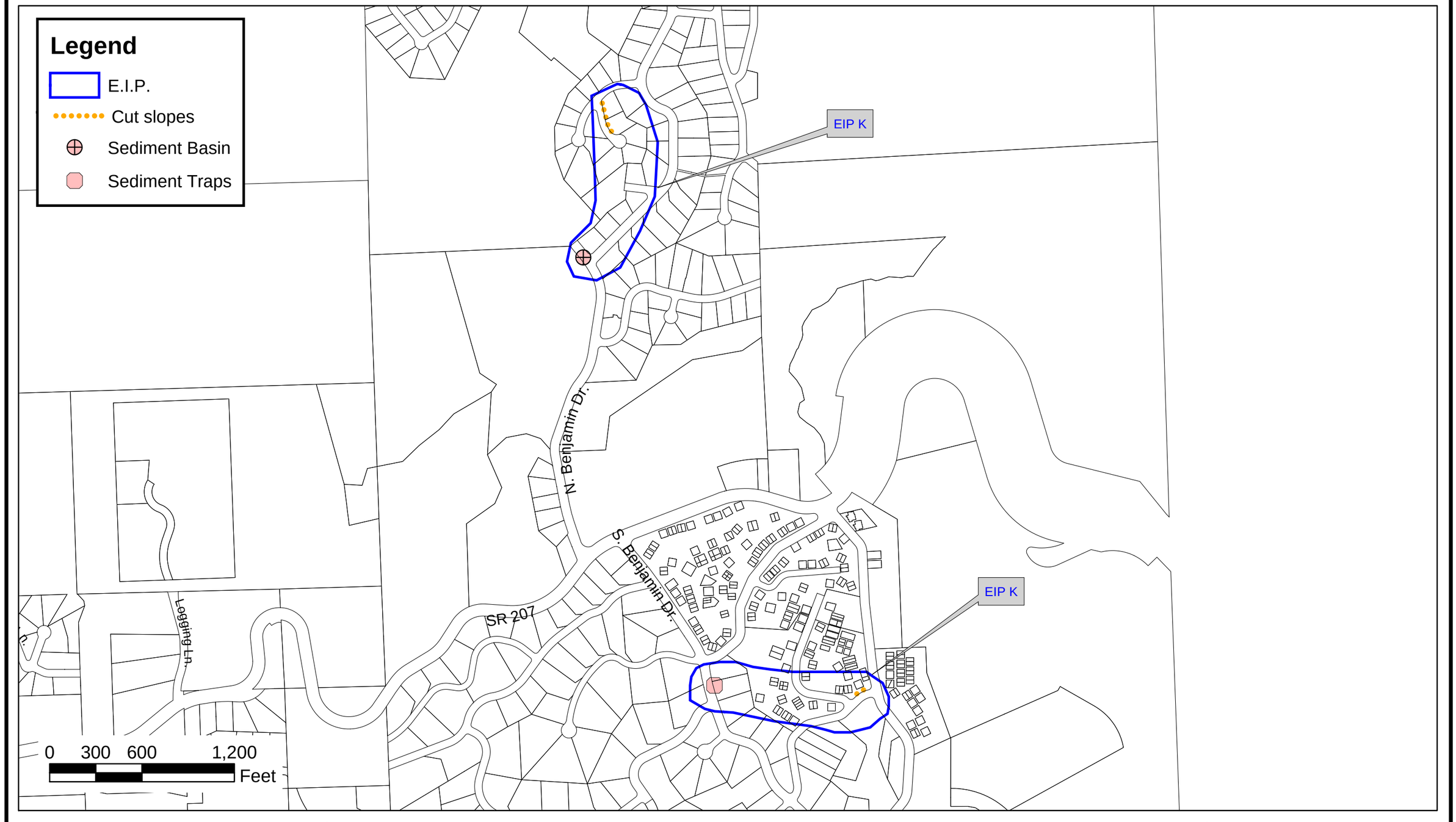
N W E S



Edgewood Creek Integrated Watershed Assessment Team	**Upper Kingsbury (SR 207) Opportunities** **Proposed Edgewood Creek Watershed EIP** C:\GIS\3090-edgewood\ndot up king defic Modified : 6/10/03	**Figure 3.6**	N W E S



Edgewood Creek Integrated Watershed Assessment Team	**Lower Kingsbury Subdivisions Opportunity** **Proposed Edgewood Creek Watershed EIP** C:\GIS\3090-edgewood\kgid mid king defic Modified : 6/10/03	**Figure 3.7**	N W E S



Edgewood Creek Integrated Watershed Assessment Team	**North Benjamin and Upper Kingsbury Opportunities** **Proposed Edgewood Creek Watershed EIP** C:\GIS\3090-edgewood\kgid mid king defic Modified : 6/10/03	**Figure 3.8**	N W E S